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If we get a supply of water necessary to wash the hands and face from one to three times each day it is considered all that is necessary. The clothing will hide whatever of dirt that might accumulate on the rest of the body. The filthy condition of the poor is responsible to a large degree for the spread of many diseases. The so-called tenement odor, which so often offends the sensitive olfactories in crowded street cars and other assemblies of the poor, emanates from the decomposed secretions of the skin which have accumulated upon their persons and found lodgment in unventilated clothing. There is a moral obligation resting upon the wealthy portion of a community to contribute freely toward the removal of this remediable evil, uncleanliness. Modern hygiene has demonstrated that the essential principles of sanitation lie in cleanliness.

We have also learned that the great panacea for the prevention of disease and premature death is in pure food, water, air, clothing, and the houses in which we live.

Doctor Mittman has shown that the crescents which adorn the finger nails of uncleanly people, their hair, skin and clothing abound in saprophytes, and that the lives of these parasites are imperiled by cleanliness and that they thrive only in filth. Every intelligent man knows that personal cleanliness is an important element in the health problem.

Personal cleanliness, so vital as a hygienic measure, must be carried to the forefront in our battle for a more perfect sanitation. Perfect compliance of all classes of people with sanitary laws will aid materially in the prolongation of human life and lessen sorrow and suffering in the world.

No argument is required to prove the necessity nor the present demand for public baths and no efforts should be instituted to thwart so great a public beneficence. Prompt action is demanded along this line of humanitarian work. Cleanliness means health; it means preservation of life; it means moral improvement; it means an uplift to all that is good and pure in the world.

Color in Nature.

J. E. Todd.

Light, like sound, consists of vibrations capable of producing a conscious impression upon sentient life. In sound they are of ordinary matter, usually air, appreciated mostly by the ear. In light they are much more delicate and mysterious vibrations of ether, which affect the eye. Color is a property of light, dependent upon the length or rapidity of such vibrations, just as pitch is a quality of sound in a similar way.

As there are soundlike vibrations which are inaudible, so there are many waves of lightlike vibrations which are invisible. Moreover, as sound may be pitched too high or be too faint for one to hear, and yet be enrapturing melody to another, so doubtless some organisms perceive delicate colors which are invisible to man. Our subject is too vast for us to consider more than the infinite variety of patterns and tints which appeal to the human eye in nature.

CAUSES OF COLOR.

Color, from a physical standpoint, is an accident or coincidence. It is simply the result which follows from the relation of the dimensions of molecules, or masses, to the length of ethereal waves. Colors may be classified, from their causes, into absorption colors, interference colors, and refraction colors.

Sunlight, or any white light, consists of all kinds of color waves mingled together. If these fall upon any object whose ultimate particles or molecules correspond in size to the length of any particular color, as red, for example, so that they begin to vibrate in harmony with the red wave, such vibrations are said to be absorbed, and change to heat, chemical or electric vibrations, as the case may be. In such conditions the waves not so absorbed, which give the sensation of green, would be reflected from the surface, and the object would be called green. So with the absorption of any other color or colors by a pigment or any object. Under this head come the great majority of colors in nature.

In the case just mentioned light is reflected in a radiant manner from all points of a substance; in other cases, where the surface is smooth, the reflection is like that from a mirror. As light strikes the surface of a thin, transparent film a portion is reflected and a portion enters it and is reflected from the opposite surface. If the surfaces are at such a distance that the wave lengths of a certain color interfere, that color is destroyed, and only the color waves not so destroyed will be visible. If red is destroyed the rest of the light will be green, and the film at that point appear green.

Again, if light falls upon striæ or thin lamina similarly related to the length of light waves, interference may also occur and similar results will follow. As an example of film interference we may refer to the colors of a soap bubble, or of oil upon the surface of water; the wings and epidermis of insects frequently exhibit it. As examples of the other sort we may instance the changeable colors of mother-of-pearl, also of certain metallic plumes of birds.

Other colors are caused by the refraction of light in passing through transparent bodies, as in the flash of the diamond or dewdrop, the tints of the rainbow, the mock sun.

All visible objects must have some color, for color is an essential property of light by which they are seen. Many colors, however, are rarely spoken of as such, because of their dull shades. We, therefore, in good faith, will confine our attention to such marked or striking colors as are usually intended by the word.

Colors may be classed, according to their uses, into incidental or nonsignificant colors, protective colors, directive colors, and ornamental colors.

TABLE OF COLORATION OF ANIMALS AND PLANTS.

Types of Coloration.	*Examples.*
INCIDENTAL	Color of internal tissues; pearly lining of shells; perhaps dark stripe on back of a donkey and dappled spots on a Norman horse (Wallace), and the motley colors of cattle.
PROTECTIVE	*Concealing:* Gray for desert; white for snow fields; green for grassy plains; stripes of tiger for bamboo jungle; the color and form of a knot for the whip-poor-will resting on a tree.
	Warning: Bright colors on uneatable or poisonous reptiles, fishes, insects, or plants; so also on stinging insects and plants; eyelike spots on insects.
	Alluring: Most solid colors of flowers are to attract insects for cross-fertilization; an Asiatic lizard is reported to have a mouth colored like a flower to attract insects within reach; bright colors attract passers-by to ripe fruits, to scatter their seeds.
DIRECTIVE	*Recognition:* Patches or lines of color, peculiar to the species, usually associated with concealing coloration, and shown often automatically, when moving or calling; white on tail of rabbit; white or black on tail, wing or head of birds, and head, rump or tail of quadrupeds; the upper side of butterflies' wings.
	Indicative: Many markings which serve the last-mentioned above may also serve under this. The former may be seen at a distance; the latter closer by, in troops or flocks or in dens.
ORNAMENTAL	Bright-colored patches of feather, hair, scales or skin, as the case may be, which are displayed conspicuously by males, particularly during the breeding season.

INCIDENTAL OR NONSIGNIFICANT COLORS.

Under this head we place most of the colors of inanimate objects. Because of their insensate character they are incapable of being affected either favorably or unfavorably. Their existence is in no way dependent upon their relations to their color. The glitter of gold, the flash of the diamond, the azure tint of the sky, however appreciated by man, are perfectly useless to the objects themselves and are purely incidental to their molecular structure.

The same may be said of the color of blood, of internal tissues, and the delicate tints of shells. Such colors are of no service to the organism. Furthermore, the same is probably true of many colors upon the external surface, as the verdure of plants or the brighter colors of foliage plants, whose tints seem to follow or vary with the structure. So also with the haphazard coloring of domestic animals; the more regular markings which follow certain parts of the internal structure, as the black stripe along the back of a donkey or the dappled spots upon a Norman horse, which seem to be collections of pigment somewhat after the principles of mineral concretion. Wallace is disposed to refer to this cause much of the gaudy coloration of the males of many species of birds. The brilliant colors he thinks are simply incidental manifestations of exuberant vitality, but such cases are quite differently interpreted by others. Incidental colors may be looked upon as the primitive coloration of animals and plants, which have furnished the material from which natural selection has developed colors which are of service or use to the organism, and under this head we find the other classes of color which we have mentioned.

PROTECTIVE COLORS.

Under this we include all patterns and tints of coloration which are of service in protecting the organism and its enemies and also for enabling it to catch its prey. This class may be subdivided, therefore, into *concealing* colors, *warning* colors, and *alluring* colors. The first includes all coloration which tends to hide the organism. The more common examples are those of dull gray for animals inhabiting desert regions, white for those in snowy countries, some greenish tint for those frequenting leaves or grass, transparency for water animals. Sometimes the animal has its color changed from gray to white when the snow falls; in such cases it seems that a certain sensitiveness to light resides in the hair or skin. This is seen in the ermine, the arctic hare, and ptarmigan. Sometimes the color is changed by some effect through the nervous system upon the pigment cells of the skin. This is notably true of the chameleon, and in less degree in some tree toads. Somewhat similarly, chrysalids of certain insects conform to the objects they rest upon. In other cases concealment is curiously secured by coloring of the plant or animal to resemble some inanimate object. The whip-poor-will is colored to represent a knot on the side of a tree; the tiger to resemble the light and shade in a bamboo jungle; sunbirds are colored like the flowers they frequent.

Many insects, in either larval or adult stages, by their color and form imitate so closely the leaves, twigs or thorns that they are practically invisible. The underside of the wings of many butterflies cause them to resemble dry leaves.

On the other hand, some small animals and insects which are uneatable or harmful advertise the fact by exhibiting bright colors in sharp contrast with surrounding objects. Such *warning* colors are found in the skunk, many snakes and other reptiles, bees, wasps and many other insects, sea animals, and bright-colored corals.

Some are protected by their resemblance in coloring to others which are harmful. Beetles are in some cases shaped and colored like wasps or stinging ants. Many caterpillars are furnished with eyespots and other marks to make them appear monstrous and dangerous to birds. Probably the eyespots on the wings of some butterflies serve a similar purpose.

Other colors which are calculated to *allure* insects or other animals, so that they may be captured for food, may also be grouped under protective colors. An Asiatic lizard has its mouth colored brightly so as to resemble a flower, so that insects draw near it and are taken. A species of mantis in India resembles a pink flower, and so attracts insects within its reach; so also with some spiders.

Thus far we have spoken mainly of animals. Plants may also be protected by their coloration. This is not so often by the possession of hiding colors or warning colors, but more by alluring colors, although not for injury to their victims. All showy flowers are now looked upon as a device of nature to promote cross-fertilization in plants. The insects scour the fields for food; each species of flowers presents a particular color as a signal which indicates that it has food for it at hand. An insect visits a plant to gather the nectar or pollen, and dusts himself more or less with pollen, which he carries to a neighboring plant of the same species; and so from plant to plant through the day; or, if of nocturnal habit, through the night. Myriad and wonderful indeed are the devices which nature has formed to promote this process—forms of flowers, often very complicated, and the arrangement of flowers—but in nearly all color is the main attraction. Sometimes it is odor.

"Hence we may conclude," as Darwin says, "that if insects had not been developed on the earth our plants would not have been decked with beautiful flowers, but would have produced only such poor flowers as we see on our fir, oak, nut and ash trees, on grasses, dock and nettles, which are fertilized by the wind." This idea has grown greatly in favor since its first announcement. From crocus to aster, and from violet to magnolia, the same story comes. Thus the difficulty of the poet who sang of the violet "born to blush unseen and waste its sweetness on the desert air" is satisfactorily solved.

Alluring colors are also important to edible fruits. How they shine out and notify the passer-by that they are ripe and ready to have their seeds scattered. The blush of the peach, the gold of the orange, the glitter of the blackberry, all exist mainly because of their utility to their species. This form of alluring coloration brings us by an easy stage to our next general class:

DIRECTIVE* COLORS.

This class includes all which are in any way useful to a species, by securing its recognition by its friends, or by enabling them to judge of its attitude and probable movement; hence it is easily separated into what we may call *recognition* colors and *indicative* colors. Both functions may sometimes be served by the same marks. It will be seen that recognition colors have a purpose exactly opposite to that of concealing colors, but they are often exhibited in the same animal. One of the early puzzles to evolutionists was the white tail of the rabbit, which seemed an obvious disadvantage. A little study, however, discovered its utility in enabling rabbits to find or follow one another in the twilight. So animals protected by hiding colors invariably have some conspicuous stripes or spots of striking color, usually white or black, on tail, rump or wing. They are commonly concealed when the animal is hiding or at rest, but are automatically displayed when the animal is in motion or when calling its fellows. The white or black tails of deer, the white feathers in the tail and wings of finches, the bar across the tail of the turkey, the white rump of the flicker, are all examples of this class; also the bright colors upon the upper surface of butterflies' wings. Very likely the color of crow, bluebird or scarlet tanager may come under this class, although they may possibly belong to warning colors.

Indicative colors are especially important to animals which move in flocks. They are helpful not only when moving in a mass, but also when resting at night. Similar marks are serviceable to animals which frequent dens. Under indicative colors we would class: (*a*) Conspicuous streaks or contrasts of color about the head, as in the raccoon, badger, antelope, etc.; also in the hawks, sparrows, geese, etc. (*b*) Spots and lines on the sides and legs, as in zebras, peccaries, antelope, wild asses, hunting dogs, etc. (*c*) Various spots and lines appearing only in the young as in fawns, the cubs of some Felidæ and Suidæ. These are of temporary service while they are confined to their hidingplaces.

But indicative coloration is not confined to animals, though, of course, it appeals to the intelligence of animals. Under this head, we judge, rightly belong most of the delicate markings upon flowers which are too small to be seen at a distance. They have been called "guide lines" and "spots," because they show the visiting insect or bird the way to the nectar. They are found especially in flowers of irregular or complicated structure. They occur in the violet, iris, lobelia, etc. They often add greatly to the beauty of the flower.

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* This term was first suggested by the writer, 1888. American Naturalist, XXII, p. 201.

ORNAMENTAL COLORS.

We now come to a branch of our subject which may be more welcome to some who may have thought that our interpretation of nature is too utilitarian. Though we have traversed by far the most extensive portion of our field, we have not yet considered some of the most wonderful and beautiful manifestations of animal coloration, which by most naturalists are believed to bear witness to the existence of an æsthetic sense in animals. I refer to the graceful crests and brilliant plumes of many birds and other bright markings on mammals, fishes and reptiles. It is usually associated with marked differences between the sexes, and is often limited to the males, and, moreover, is most conspicuous during breeding time:

> "In the spring a fuller crimson comes upon the robin's breast;
> In the spring the wanton lapwing gets himself another crest;
> In the spring a livelier iris sparkles on the burnished dove;
> In the spring a young man's fancy lightly turns to thoughts of love."

The gemlike beauty of the humming bird, the marvelous plumes of the different paradise birds, the tails and wings of the pheasant, including the peacock, the bright-colored combs and wattles are all mainly restricted to the males. The females, though sometimes reflecting the peculiarities of the male, always present them in subdued form; so with many brilliant stripes and colored patches found on antelopes, monkeys, lizards, fishes, and in insects. Wallace tries to ascribe all these to exuberant vitality, together with the need of recognition colors upon the part of the males, and the counteracting need of protective colors for the female during incubation and the care of their young. The consensus of opinion, however, of other students of the subject is clearly in favor of Darwin's view, as first announced in his theory of sexual selection. This is simply a natural selection, acting through and perfecting an æsthetic sense of the opposite sex. Love and the love of beauty under Nature's laws have wrought this miracle of splendor.

Thus have we viewed all too hastily the broad field of color in nature, with its almost infinite range of pattern, tint and shade. We have seen how it has been an important factor in the development of living forms. Although born of apparently accidental coincidences, color has, in the beneficent hands of Nature, protected the weak and timid. By its system of natural heraldry, unconsciously produced by natural selection, it has awakened and stimulated their powers of discrimination and judgment, so that they have acquired the use of a sign language, which in turn has developed their social instincts and habits. It has aroused and cultivated an æsthetic taste, which has, by reaction, still further beautified nature and natural forms.

All these enlargements of comprehension and appreciation through the general current of life have been shared in by many, but by none so much as by man, the crown of all, the "heir of all the ages." Endowed with the mysterious power of self-consciousness, he is able to look down upon himself and the whole labyrinth of Nature's workshop in which he finds himself playing a part. Aside from and above the uses which we have been considering, he sees higher relations and deeper significance. His divinely equipped soul sees the spiritual side of the tapestry of life and begins to comprehend the picture for which it was all woven.

> "To him who in the love of nature holds
> Communion with her visible forms she speaks
> A various language."

These the artist learns to interpret and to express in tint and form, and the poet in word and rhythm. They become a vocabulary to impress the noblest, gentlest and sublimest thoughts and feelings. Flowers, gems and brilliant birds become letters in this wonderful alphabet.

Nor can we contemplate such a perplexity of influences and relations acting, reacting and interacting without recognizing the existence of a beneficent Intelligent Mind, as the only adequate explanation for it all. We realize that we have been permitted to enter the laboratory of the Infinite, to learn something of His methods of work and to think in our feeble measure some of His wonderful thought after him.

A New Nesting Record for the Pine Siskin.

F. F. Crevecoeur.

May 3 of last year I discovered the nest of a bird in a cedar tree by the house containing three or four recently hatched young. The bird appeared unfamiliar to me. It had much the looks of a sparrow, and Lincoln and Harris' sparrows had been seen about the place; but as these birds are not supposed to nest this far south, I was greatly puzzled as to the bird's identity. One of the birds was nearly always to be seen on the nest, and I used a spyglass to get a good look at it, but I could not place it. One day I saw near by another bird, which was evidently the mate to the one on the nest, and as it flew about I noticed it had a forked tail—a character not common among sparrows. This gave me a clew on which to work. Consulting Goss's "History of the Birds of Kansas," I soon came to the conclusion that the bird must be the pine siskin. But Goss in his book says: "Winter sojourner; not uncommon. Remain until late in spring. . . . They breed from the northern United States (much farther south in the Rocky Mountains) northward throughout the British possessions." So I could not be sure as to the bird's identity. I wrote to the Bureau of Biology to send a man out, if they could, who would be able to identify the bird. Dr. E. W. Nelson, chief of the Bureau, wrote in reply that a man could not be sent out, but it would not be improbable that my bird was in reality the pine siskin, as it had been known to breed on several occasions at Omaha, Neb., and it was quite possible the bird might breed as far south as Onaga, Kan. By the time Doctor Nelson's letter reached me the young had left the nest and the birds were not seen afterward.

Last September I made a trip to Topeka, and while there I looked up the pine siskin in the Goss collection of birds in the museum there, and immediately recognized the bird to be the same as the one I had under notice; so there can be no question as to its identity.